APPENDIX I

In a previous study[1] we have described parameters for a photo reconnaissance system that provides for a growing intelligence yield based on logical technical growth. As a consequence of this study we now propose to conduct design and development that will provide for delivery, installation and test of a single completed camera sub-system in the shortest possible time from the date of contract.

Our study has convinced us that the greatest long-term growth potential is available through operations from a stable platform with a system that employs an optimum match of aperture, focal length, exposure time, emulsion type and processing.

The sub-system we propose for development will be designed to operate from a furnished stable platform and will supply film in appropriate form and manner to a recovery capsule. The camera sub-system will incorporate the lens, camera body, film advance and exposure mechanisms, image movement compensation, the mounting to the stable platform, driving mechanisms, and controlling devices. These latter include a programmer, a receiver and a transmitter. The controlling devices will be made compatible with the requirements of the other elements of the system.

To achieve such a system, we propose participation jointly with the vehicle contractor and the capsule contractor in the over-all systems design.

Initially a systems design team must define vehicle performance tolerances and weight and space limitations. The camera and capsule sub-systems will be made compatible with the space and weight limitations. Because of the urgency of the program, immediate and concentrated effort must go into this task of fixing optimum design parameters.

Certain characteristics of the camera sub-system are clear from our previous studies, although their further precision must await efforts by the systems design team. The camera will be panoramic and will contain image movement compensation that is incorporated directly in the panoramic sweep motion. To achieve the differential IMC the transverse sweep will be directly guided along a cosine curve that will depart approximately ± 6 millimeters from a linear transverse sweep. The adjustment of IMC to cover the range of vehicle performance tolerances is achieved by varying the transverse sweep rate during the active portion of the cycle. By such means we are assured that a minimum of 95% IMC will be achieved under all operating conditions. The film advance will be rigidly tied to and driven by the sweep mechanism to insure synchronization. In the initial system, IMC will be controlled from the orbital computer.

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1 Systems Parameters Study (Pertaining to the Program under Consideration) 17 February 1958. ITEK Corporation.

The specific lens type will be determined only after space-weight characteristics are assessed. Delivery schedule requires that the design be restricted to readily available glass types. Optimization of the design will be achieved starting with the fixed parameters of weight and space, then exploring the range of focal lengths, apertures, emulsions, photo processing combinations that are feasible within these fixed parameters. The camera will then be designed to provide maximum information yield while performing over the entire range of vehicle operating tolerances and under the illumination conditions that are projected for the operational season. The method for determining this design optimization is outlined in our previous study. Additionally we have since undertaken certain theoretical studies heading toward quantitative criteria for optimizing photo reconnaissance systems, and these studies could well find practical application in the present problem.

Although we are prepared to design to either or both a summer or winter operational season, we are compelled to point out the inherent advantages in design simplicity and in speed of development (weight limitations, glass procurement, etc.) in an initial design directed to summer operation.

The film take-up mechanism will be designed in cooperation with the capsule contractor to insure compatability with the capsule.

Discussions with representatives of the capsule company confirm that the weight, balance and configuration limitations are such as to enable the incorporation of the entire camera in the capsule. This, as concluded in our previous study, not only improves over-all system weight and balance characteristics but markedly improves over-all system simplicity. If further studies by the capsule company confirm that the quartz window can be integrated with the capsule surface, this would seem a preferred approach.

On the assumption that a reasonably stable platform is furnished in the vehicle such a camera will produce photographs of a quality comparable to that traditionally used in the task of building counts. Stereo, however, will not be considered in the initial system.

In order to assure both reliability and quality of performance we will provide both field services and ground check-out equipment to enable complete testing of the installation. In addition we propose using the best available facilities in the country for environmental testing during the development. Under active consideration are the AVCO shake tables and temperature chambers.

We further propose to deliver simultaneously with unit deliveries such space parts as the study indicates are desirable.

The field services will include installation--periodic check-out and adjustment including final check-out.

We propose to furnish full reports, monthly progress reports, specifications and operations and maintenance manuals will be furnished consistent with project progress.

Because of the recognized urgency of the program, we will establish a separate project organization that will be prepared to devote 100% time to the task starting from the date of contract. This organization will be manned by personel experienced in similar programs. It will report through a management channel also experienced in both this type of problem and this type of design.

Tentative Schedule for Systems Design and Prototype Development

WEEK 1

Establish:

1) Vehicle Performance Tolerances
2) Weight, space and moments limitations and tolerances for Camera Sub-system
3) Definition of the form, parameters and preliminary engineering specifications of each interface
4) Demands on and requirements for the receiver transmitter and programmer
5) Operational Season or Seasons

WEEK 2

1) Establish performance specs for camera sub-system
2) Preliminary mock-up of camera compartment
3) Configuration studies
4) Film-lens processing studies
5) Performance specs for programmer, receiver, transmitter
6) Initiate design on film drive mechanisms
7) Initiate design on IMC
8) Initiate design of testing programs
9) Preliminary lens design

WEEK 3

1) Fix on lens-film processing combination
2) Fix on configuration(s)
3) Initiate lens design
4) Initiate camera design(s)
5) Fabricate mock-ups of configuration(s)
6) Initiate design of programmer, receiver, transmitter
7) Initiate arrangements on procurement of test facilities
8) Initiate design of special test equipment
9) Studies on compatability of existing processors with precessing requirements.

WEEK 4

1) Processing and Processor specifications established
2) Preliminary tests of film transport mechanisms
3) Specifications of complete testing program and testing schedule established. To include three successive and successful test exposures of all components to Shock, Temperature, Vibration, Acceleration, Life, Noise, Humidity and Altitude.
4) Review of complete sub-system program including status, schedule, weight, space, moments calculations, performance predictions, etc. to confirm and fix on the over-all sub-system design, the schedule, the supporting operations and the over-all system design compatability.
5) Working bread board test model from on the shelf components

WEEK 5

1) Camera components start to engineering
2) Receiver and transmitter into fabrication
3) Test of IMC mock-up
4) Special field test equipment into design
5) Arrangements for test facilities completed

WEEKS 6-8

1) Lens design completed - glass ordered
2) Lens design intergrated to configuration
3) Over-all camera design initiated
4) Initial camera components into test
5) Programmer into fabrication
6) Environmental testing of components initiated
7) Lens mountings and lens performance into environmental testing.

WEEKS 9-16

1) Lens fabrication initiated
2) Lens mount fabrication initiated
3) Complete camera fabrication underway.

WEEKS 20-28

1) Lens Assembly and test
2) Environmental testing of camera mechanisms and lens mounting
3) Moments testing initiated

WEEK 32

1) Laboratory testing of complete sub-system

WEEKS 33-34

1) Environmental testing of complete sub-system

APPENDIX II

ITEK EXPERIENCE

Relevant Experience

Personnel of ITEK Corporation have unique experience in areas directly related to the specific content of this proposal. Several members of the group have had broad experience in the field of aerial reconnaissance and have served on national and Air Force reconnaissance-intelligence planning groups. The consequent broad understanding of concepts is reinforced by experience in the design of operational intelligence-reconnaissance systems and a quick reaction fabrication capability. Specifically, this group has been responsible for the design and development of the major long-focal length oblique camera systems which comprise today's Air Force capability. The 240 inch Boston camera was delivered to the Air Force eleven months after date of contract. It was followed several years later by an extremely compact light-weight 240 inch camera system which was designed and fabricated in four months. Additionally, a 240 inch focal length missile tracking camera of the Cassigrain type was designed and developed in an extremely short time.

Project 119-L required a study of possible photographic installations to obtain a maximum amount of information from the rather unusual flight characteristics of the vehicle. A totally new concept of camera design was originated and a working model fabricated within four months. Furthermore, this organization monitered the production of the final configuration of this camera, maintaining liaison between the Air Force and five camera manufactures. The total quantity of cameras required were delivered to the Air Force within one year.

On a similar study program for Air Force Cambridge Research Center the latest state of the art was applied to the development of the HYAC camera for System 461-L. This camera, yielding consistent results of the order of 100 lines/millimeter and using the panoramic principal, was designed and developed in six months from the date of contract.

Each of the above operational developments has turned out to be emminently successful. We attribute this to the philosophy of approach. In each case the system design was initiated by an evaluation of user requirements. In several cases interpretation aids were developed in order to achieve compatability with these requirements. In addition to this demonstrated ability to produce to quality with a quick reaction capability, the experience in (panoramic) camera designs similar to that proposed, is both extensive and unique, starting with the development of the first panoramic camera used in aerial photography, the whirling dervish (1948), and extending through to the present highest quality camera in USAF inventory (the HYAC).

Our proposed separate project organization is shown on the following page.

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APPENDIX III

Item I - System Design and Prototype Model

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1.	Executive Engineer [redacted]		$14,000.00
2.	Senior Engineers		34,800.00
3.	Junior Engineers		24,000.00
4.	Research Technicians		8,400.00
5.	Drafting		10,200.00
6.	Sub Total	25X1A10	91,400.00
7.	Technician (fabrication) [redacted]		29,700.00
8.	Engineering O/h (100% of line 6)		91,400.00
9.	Fabrication O/h (150% of line 7)		44,550.00
10.	Purchased parts and materials		10,000.00
11.	IBM service [redacted]	25X1A10	13,000.00
12.	IBM punch card operator [redacted]	25X1A10	262.00
13.	Travel		5,000.00
*14.	Environmental Test		3,000.00
15.	Communications and Shipping		5,000.00
16.	Sub Total	25X1A10	293,312.00
17.	General and Administrative O/h [redacted]		29,331.00
18.	Total Estimated Cost	25X1A10	322,643.00
19.	Fixed Fee [redacted]		32,264.00
20.	Total Estimated Cost plus Fee		$354,907.00

*Government furnished equipment and facilities assumed.

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APPENDIX III

Item II - Twelve (12) Service Test Models and Field Services

25X1A10

1.	Senior Engineers	[redacted]	$72,000.00
2.	Junior Engineers		16,000.00
3.	Research Technicians		14,000.00
4.	Sub Total	25X1A10	102,000.00
5.	Technicians (fabrication)	[redacted]	243,000.00
6.	Engineering O/h	[redacted] 25X1A10	102,000.00
7.	Fabrication O/h	[redacted] 25X1A10	364,500.00
8.	Purchased Parts and Materials		120,000.00
9.	Travel		23,000.00
*10.	Environmental Test		12,000.00
11.	Manuals and Specifications		5,000.00
12.	Communications and Shipping		12,000.00
13.	Sub Total	25X1A10	983,500.00
14.	General and Administrative O/h	[redacted]	98,350.00
15.	Total Estimated Cost		1081,850.00
16.	Fixed Fe[redacted]	25X1A10	108,185.00
17.	Total Estimated Cost plus Fee		$1,190,035.00

* Government furnished equipment and facilities assumed.

Item II - Travel

24 trips to California at $400.00	$9,600.00
14 days x 24 x $40.00/per diem	13,440.00
	$23,040.00

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21 April 1958

SUMMARY OF PROPOSAL

Attached herewith is a proposal for the design and development of a panoramic camera system for use in a specialized vehicle.

ITEK Corporation is well aware of the importance of this project to the national security, and is prepared to devote its best corporate efforts to insure the success of the program. We believe our background in the field of intelligence and reconnaissance uniquely qualifies us for the design and development of the photographic instrumentation under consideration.

Appendix I contains a specific proposal including the background of the problem, and a brief technical discussion. Appendix II contains the company background and relevant experience of ITEK Corporation which we believe is particularly applicable to this project. Appendix III contains an estimated cost summary for the total project. These costs are based on a cost plus fixed fee type of contract and include the development of a proto type, followed by twelve operational units. Field services of two field representatives are included in the cost estimates.

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